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CLAIMS:

5        1. An optical device, comprising a laser diode having a ridge waveguide located above an active layer, and having a distributed reflector in the form of a lattice of individual elements, wherein the elements are arranged in a two-dimensional array on either side of the ridge waveguide.

10      2. An optical device as claimed in claim 1, wherein the distributed reflector comprises a structure in material above the active layer on either side of the ridge waveguide.

15      3. An optical device as claimed in claim 1 or 2, wherein the two-dimensional array is in a plane parallel to the active layer and extends to a depth comparable to that of the active layer.

20      4. An optical device as claimed in claim 1, 2 or 3, wherein the individual elements are holes.

25      5. An optical device as claimed in claim 4, wherein the holes are arranged in a hexagonal array.

6. An optical device as claimed in claim 4, wherein the holes are arranged in a square array.

25      7. An optical device, as claimed in one of claims 4 to 6, wherein the holes extend to a depth comparable to that of the active layer in a direction that is perpendicular to the plane parallel to the active layer.

30      8. An optical device, as claimed in one of claims 4 to 6, wherein the holes extend to a depth comparable to that of the active layer in a direction that is not perpendicular to the plane parallel to the active layer.

35      9. An optical device, as claimed in one of claims 4 to 8, wherein the holes are regions of different refractive index to that of the device structure.

10. An optical device, as claimed in one of

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claims ④ to 9, wherein the holes are regions of different gain or loss to that of the device structure.

5 11. An optical device, as claimed in one of claims ③ to 10, wherein the distributed reflector does not pierce the active region.

12. An optical device, as claimed in one of claims ③ to 10, wherein the distributed reflector partially pierces the active region.

10 13. An optical device, as claimed in one of claims ⑧ to 10, wherein the distributed reflector fully pierces the active region.

14. An optical device, as claimed in any ① preceding claim, wherein the distributed reflector is within the device.

15 15. An optical device, as claimed in claim 14, wherein the distributed reflector is within a pumped region.

20 16. An optical device as claimed in claim 14, wherein the distributed reflector is within an un-pumped region.

17. An optical device as claimed in any preceding claim, with means for varying the electrical bias or biases applied to the device to obtain efficient optical emission in single wavelength operation. ①

25 18. An optical device, as claimed in claim 17, wherein the emission wavelength may be controlled/tuned.

30 19. An optical device, as claimed in any ① preceding claim, which is integrated with separate amplifying, absorbing or passive sections.

20. An optical device, as claimed in claim 19, where the amplifying or absorbing sections have gain/loss modulation.

35 21. An optical device, as claimed in any ① preceding claim, with means for being pulsed by gain switching, Q-switching or mode-locking techniques.

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